

Research article - History of anatomy and embryology

## Caspar Bauhin (1560-1624): Swiss anatomist and reformer of anatomical nomenclature

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### Abstract

Caspar Bauhin (1560-1624) was a Swiss anatomist, physician and botanist. He commenced the study of medicine at a young age in Basel but had to move to Padua after an outbreak of plague in his native place. In Padua, he was privileged to study under Fabricius ab Aquapendente, an accomplished anatomist of his time, and other pioneers in the field of medicine, surgery and botany. He travelled extensively through Italy, France and Germany before finally returning to Basel, where he started to conduct public anatomy dissections and in due course was appointed to the Chair of Anatomy and Botany at the University of Basel. His treatise, *Theatrum anatomicum* (1605), was considered as the finest comprehensive text in anatomy during that period. *Theatrum* was highly appreciated as it followed a systemic approach with focus on anatomical anomalies and had a useful set of illustrations. His major contribution to Anatomy was the introduction of a descriptive terminology which replaced the prevalent trend of naming the structures with ordinal numbers and cleared the confusion among anatomists in relation to identification of structures. He was the first to describe the anterior lingual glands (Bauhin's gland), which are seromucous glands located near the tip of tongue. He is presumed to be the first to report the ileocecal valve, which is also known as Bauhin's valve. Bauhin's contributions are a true testimony of his legacy in the domain of anatomical sciences.

### Key words

Anatomical nomenclature, Bauhin's gland, Bauhin's valve, theatrum anatomicum, anatomical illustrations

### Introduction

Caspar Bauhin or Gaspard Bauhin was a Swiss anatomist, physician and botanist, who was born in Basel on 17<sup>th</sup> January, 1560 (Fig. 1). He belonged to a family spanning six generations of physicians and natural scientists (Whitteridge, 1970). He was the youngest son of Jean Bauhin (1511-1582), an eminent French physician, who was compelled to leave his native country on becoming a convert to Protestantism (Rose et al., 1841). As a child, Bauhin was remarkably weak and feeble and could not speak clearly until five years of age. However he commenced the study of medicine at a very young age under the guidance of his father and brother Johann Bauhin (1541-1613), who himself was a famous physician and botanist (Mägdefrau, 1992). In 1572, Bauhin entered the University of Basel, where noted Swiss physicians, Theodor Zwinger the Elder (1533-1588) and Felix Platter (1536-1614) were among his teachers.

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**Figure 1** – A portrait of Caspar Bauhin. Image in public domain.

He received the degree of Bachelor of Philosophy in 1575 and conducted his first medical disputation in 1577 (Martensen, 2001). However a severe epidemic of plague broke out in Basel in 1577 and he moved to Padua, the most prominent European university in the field of medicine during that period (Hugh, 1911; Taylor, 2009; Porzionato et al., 2012). In Padua, Bauhin attended lectures of Fabricius ab Aquapendente (1533-1619) and Archangelo Piccolomini (1525-1586), who were pioneers in the field of anatomy. He attended the dissection of seven human cadavers being performed by Fabricius and even assisted him in private dissections. He stayed in Padua for 18 months and the influence of such illuminating personalities were evident as he got passionately attached to anatomy (Isely, 1994). He then travelled all over Italy, visited Bologna and received instructions in anatomy from Giulio Cesare Aranzio (1530-1589), before moving to Montpellier, where he signed the register in the spring of 1579 (Hugh, 1911; Gurunluoglu et al., 2011). However Bauhin spent more time in Paris, attending anatomy sessions conducted by Séverin Pineau (1550-1619), Professor of Anatomy and Surgery. He even assisted Pineau in undertaking dissection at his request (Whitteridge, 1970). Towards the middle of 1580, Bauhin arrived at the University of Tübingen in Germany with the purpose of receiving lessons in Botany (Jahn, 2000). He had the intention of making an extensive tour of Germany, but was recalled to Basel in early 1581, as his father was at the point of death (Rose et al, 1841).

## Bauhin's career at Basel

On his return to Basel, Bauhin began to dissect bodies at the request of the College of Physicians. He held his first public anatomy dissection on February 27, 1581, when under the guidance of Felix Platter he conducted the section of a male body in presence of about 70 spectators. The spectacle lasted for five days and was a remarkable one as no such sections had been executed in Basel for the past ten years (Whitteridge, 1970). Bauhin held his doctoral disputation on the subject *De dolore colico* on April 19. He was conferred the title of Doctor of Medicine on May 2, and on May 13 he was made a member of the Faculty of Medicine at the University of Basel. From that time, he taught both Anatomy and Botany in Basel. He conducted public anatomical dissections during winter and took the students to botanical expeditions in the summer (Bergmann and Wendler, 1986). Bauhin was made professor of Greek language in 1582 and two years later he became *consiliarius* in the Faculty of Medicine, an office he held until his death. He was dean of the Faculty of Medicine nine times, beginning in 1586, and was elected rector of the University of Basel four times from 1592 onwards (Rose et al., 1841). As a result of his efforts, University authorities initiated work for building a permanent theatre for anatomical demonstrations and a botanical garden was laid out in the University campus. In 1589, while still a professor of Greek, he was appointed professor of Anatomy and Botany, a special chair created for Bauhin (Jahn, 2000). During all these years, his reputation as a medical practitioner grew in Basel, and in 1597 he, along with his brother Johann, were appointed personal physician to Duke Friedrich of Württemberg (1557-1608). After the death of Felix Platter in 1614, Bauhin succeeded his teacher as *archiator* (chief medical officer) in the city of Basel, and the following year was appointed professor of Practical Medicine (Kyle and Shampo, 1979). He died on 5<sup>th</sup> December, 1624, in Basel (Whitteridge, 1970).

## Reformer of anatomical nomenclature

Bauhin's major contribution to the study of Anatomy was reforming the anatomical nomenclature, which has a long evolutionary history. Hippocrates and other ancient anatomists had to develop a dictionary in order to communicate their observations. Galen established a comprehensive nomenclature derived from Greek, which was very extensive (Sakai, 2007). Anatomical nomenclature grew enormously and haphazardly with innumerable synonyms from the second to the sixteenth century. Consequently anatomists found it extremely difficult to express themselves (Kachlik et al., 2009). Andreas Vesalius (1514-1564) described the anatomical structures in *De Humani Corporis Fabrica* (1543) with the help of a highly sophisticated but difficult nomenclature system, whereby he replaced all Greek and Arabic terms with Latin ones. He distinguished between muscles, bones, blood vessels and nerves with ordinal numbers (Sakai, 2007). During that period, anatomists had named different anatomical structures in this way, however they did not agree on the order of enumeration (Bradley and Willich, 1799). In the late sixteenth century Bauhin adopted a descriptive anatomical nomenclature in his publications, in order to clear the confusion over the ordinal-based one. He collected almost all the synonymous anatomical terms prevalent in that period and replaced them with more specific ones to describe muscles, vessels

and nerves (Sakai, 2007). Bauhin termed some muscles on the basis of their substance (semimembranosus), others on the basis of their shape (scalene), some on the basis of their origin (arytenoid), and others on the basis of their origin and insertion (styloglossus, cricothyroid). Some were termed on the basis of their position (pectoralis), some on the basis of their volume (vastus, gracilis), and others on the basis of their use (supinator, pronator). Bauhin also introduced the terminologies of veins and arteries based on their use or course and that of nerves on the basis of their function (Kyle and Shampo, 1979). His nomenclature system had obvious advantages over the old method and was embraced by all contemporary as well as future anatomists (Sakai, 2007).

### Published works in anatomy

Bauhin's contribution as a teacher of anatomy was substantial, particularly through his textbooks on the subject. His first text was *De corporis humani partibus externis* (1588), which was a succinct, methodical account of the external parts of the human body suitable for beginners (Bauhin, 1588). In 1590, Bauhin published his first complete textbook, *De corporis humani fabrica libri IIII*. It was a systematic account written from the point of view of dissection and was primarily intended for the students (Bauhin, 1590). An enlarged version of the text was republished in 1597 as *Anatomica corporis virilis et muliebris historia* as Bauhin introduced some corrections and added a description of female anatomy (Bauhin, 1597). In 1605 all of Bauhin's anatomical writings were brought together, revised, enlarged and published as a comprehensive text entitled *Theatrum anatomicum*. *Theatrum* was Bauhin's most celebrated anatomical textbook and was accompanied by copper engravings based on illustrations used in Vesalius's anatomical treatise *De Humani Corporis Fabrica*. *Theatrum* was highly appreciated by physicians as well as students of anatomy and its popularity could be attributed to the facts that it followed a systematic approach, gave adequate consideration to the ancient authorities, did not dwell too much into controversies, had a series of useful footnotes and mentioned anatomical anomalies as well as pathological findings (Bauhin, 1605). The quality of illustrations used in *Theatrum* were not of the highest standard, particularly if compared with those in *De Humani*, however they were adequate for anyone referring to the text during dissection (Bergmann and Wendler, 1986). *Theatrum* was probably the most widely used anatomical text in the period immediately before William Harvey (1578-1657), as Bauhin was the most cited author (after Vesalius) in Harvey's text. In fact it was Bauhin's work that Harvey chose as the basis for his Lumleian Lectures to the College of Physicians in London in 1616 (French, 2006). *Theatrum* was translated into English in 1615 by Helkiah Croke (1576-1648), court physician to King James I of England (O'Malley, 1968). Croke combined Bauhin's text with that of French anatomist Andreas Laurentius (1558-1609) and published them under the title of *Mikrokosmographia: A Description of the Body of Man* (Croke, 1615).

### Anatomical findings

Although Bauhin's anatomical works contained few novelties, he did include new anatomical findings in his published works. Bauhin is presumed to be the first

to describe the ileocecal valve, which was long known as the Valvula Bauhini or Bauhin's Valve (Nesher et al., 2006; Porzionato et al., 2012). In a number of his anatomical writings, he gives an account of how he first found the structure during a private dissection that he performed as a student in Paris in 1579 (Whitteridge, 1970). He was the first to describe the anterior lingual glands, which are seromucous glands located near the tip of tongue on each side of frenulum linguae. After his name, anterior lingual glands are referred to as Bauhin's glands or Glandula Bauhini (Dobson, 1962). Bauhin named the phrenic nerve and he is also credited with giving the name of areole to the pigmented area around the nipple (Singer, 1925). He included a description of valves present in the veins in his text *De corporis humani Fabrica libri IIII* (Bauhin, 1590). Presence of valves in veins were first demonstrated by Fabricius in 1574 in Padua, however Fabricius's findings were not published until 1603 (Fabricius, 1603). In *De corporis*, Bauhin deviated from Galen's theory and opposed the existence of pores in the interventricular septum of the heart. He opined that venous blood could more easily go to the lungs from the right ventricle through the pulmonary artery, refined there and mixed with air, and return to the left ventricle through the pulmonary veins (Bauhin, 1590). However in his later writings, Bauhin seems to have rejected his own view and endorsed Galen's traditional views as he reported the presence of conspicuous pores in the septum of an ox's heart (Bauhin, 1597).

## Conclusion

Bauhin was a truly original scientist whose influence in Anatomy lasted for well over a century. His great merit was his unmatched dedication and ability to treat his subject in an orderly and methodical manner. He was a pioneer as his anatomical nomenclature system was effective in clearing the confusion related to identification of anatomical structures and was readily embraced by anatomists. Most of the anatomical terminologies that we are familiar with in present times were introduced by Bauhin. With an extensive collection of documented works and contributions, he laid the platform for the advancement of anatomical sciences. Caspar Bauhin should be recognized and remembered as his exploits inspired generations of anatomists.

## Conflict of interest

The author hereby declare that there is no potential conflict of interest in any form concerning the author

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